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(19) (CA) **CANADIAN PATENT** (12)

(54) MULTIPLE INLET HINGELESS CHECK VALVE

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NO. OF CLAIMS 5

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The present invention relates to a non-return valve, more specifically the invention relates to a multiple inlet non-return valve for abrasive fluids.

When an abrasive fluid such as mine tailings in a water suspension is pumped through a pipe line, it is preferable to have an abrasive lining within the pipe otherwise the interior surface of the pipe is subject to excessive wear. Two or more pumps in parallel, one of which is on standby, are usually used for pumping abrasive slurries along pipelines. If one pump 10 should break down or have to be replaced, then the system still work satisfactorily with one or more of the remaining pumps. Such a system allows regular shut downs of one pump without shutting down the system. To avoid back flushing to the shut down pump, a non-return valve sometimes referred to as a check valve is fitted in the line from the pump. Preferably the non-return valve is a multiple check valve which has two or more inlets connected to two or more pumps, and one outlet leading to the pipe line.

Multiple check valves are known, however, the majority 20 of these valves rely on flap members or closure members seating over inlet ports and each flap member has a hinge at one side which pivots about a hinge pin. Such a valve is satisfactory for liquids, however, it is not satisfactory for slurries, particularly abrasive slurries, the particles in the slurry settle around the hinge causing it to jam and very shortly the check valve becomes inoperable. Attempts to provide a check valve which does not have hinges therein have resulted in one type of valve referred to as a ball check valve presently available and shown in Canadian Patent 849,308 to Harper. This valve has no pivoting 30 flap members for slurry particles to jam up. It includes a hard rubber ball moving through a path of travel from one inlet to an adjacent inlet seat. It has been found that the ball may become



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worn on one or more sides and can become stuck in the path of travel causing the valve to become inoperative.

It is a purpose of the present invention to provide a multiple inlet check valve for abrasive fluids that overcomes the problems encountered with other types of check valves used in this service.

The present invention provides a multiple inlet check valve for abrasive fluids comprising a valve housing having at least two inlet ports each of which is located on a separate surface sloped toward one another and one outlet port, the housing having an abrasive resistant lining throughout, a closure member for each inlet port, the closure member including a top abrasive resistant layer and a bottom abrasive resistant layer with a rigid disc sandwiched therebetween, the bottom abrasive resistant layer adapted to seal on the inlet port, and a flexible flap integral with the closure member joined to each inlet port.

In one embodiment each of the flexible flaps is joined to an outer edge of each inlet port remote from the other inlet ports. In another embodiment each of the flexible flaps is joined to an inner edge of each of the two inlet ports, and including a strap means between the closure members adapted to keep one inlet port open when the other inlet port is closed, and the other inlet port open when the one inlet port is closed.

In a preferred embodiment the check valve has two inlet ports and the housing is in the shape of an inverted Y. In another embodiment the abrasive resistant lining and the top and bottom abrasive resistant layers of the closure member are formed from rubber.

In drawings which illustrate the embodiments of the invention,

Fig. 1 is an isometric view partially in section of

one embodiment of a multiple inlet check valve of the present invention.

Fig. 2 is a cross sectional elevation of the multiple inlet check valve shown in Fig. 1.

Fig. 3 is a cross sectional elevation of another embodiment of a multiple inlet check valve of the present invention with a strap between the closure members.

Referring now to the drawings a multiple inlet check valve 10 is shown having a valve housing 11 with an outlet port 12 at the top thereof, and two inlet ports 13 entering the lower portion of the housing 11. The housing 11 as shown in the drawings is welded steel plate construction and has an abrasive resistant lining 14 throughout. In the embodiment shown the lining is a rubber lining having a hardness of 35 to 40 Shore A Durometer sold under the trade mark Linatex. The outlet port 12 is circular and has a standard pipe flange 15. Both the outlet port 12 and the flange surface have an abrasive resistant lining thereon. A standard pipe flange may be connected to the flange 15 so the valve can be installed within a standard pipe line.

The valve housing 11 has two lower sloped surfaces 16. These sloped surfaces 16 extend across each inlet port 13. Each inlet port 13 is enclosed in an inlet port housing 17 which in turn is connected to the valve housing 11 beneath the sloped surface 16. Between the valve housing 11 and the inlet port housing 17 is a check valve assembly 18 comprising a closure member 19 formed of flexible abrasion resistant material, preferably rubber, integral with a flexible flap 20 which is held between the main valve housing 11 and the inlet port housing 17. As shown in Figs. 1 and 2 the flexible flap 20 is at the upper edge of the sloped surface 16 so that the closure members 19 open away from each other. A seat 21 is provided on the sloped surface 16 so that when the valve is closed, the closure member

19 fits against the seat 21 thus sealing the inlet port 13. The closure member 19 has a rigid disc 22 backing onto the flexible layer so that the closure member remains rigid when the valve is closed. A top layer 23 of resilient material such as rubber, surrounds the rigid disc 22 so that the complete inside of the housing 11 is coated with an abrasion resistant material, preferably rubber, and wear is kept to a minimum. The closure member 19 remains against the seat 21 when there is no pressure on the underside of the inlet side of the valve, however, as soon as the pressure in the inlet port 13 exceeds the pressure in the housing 11, the closure member 19 opens and the flexible flap 20 guides the closure member 19 so that it moves in a substantially 90° path.

As soon as the pressure in the inlet port 13 drops so that it is equal to or less than the pressure in the housing 11, the flexible flap 20 guides the flexible member 19 down to seal the inlet port 13 against the seat 21. In the embodiment shown in the drawings, the valve is in the shape of an inverted Y having two inlet ports 13 at the bottom and one outlet port 12 at the top.

The two inlet ports 13 have standard flanges 24 which may be connected to standard pipe lines and lead to the discharge from the pumps. When one pump is operating, the closure member 19 opens and the slurry from the pump passes through the inlet port 13 into the housing 11 and out through the outlet port 12. **B** Immediately ^{after} that pump is turned off the closure member 19 drops onto the seat 21. There is hardly any slurry that flushes back through the inlet port 13 when a pump is turned off. If another pump is turned on or is running when one of the pumps is turned off, then flow continues out of the outlet port 12 without interruption. Both inlet ports may have flows pumping through at the same time, and both closure members 19 then remain open. There

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are no exposed surfaces for wear by abrasive slurries, furthermore there are no hinges or other mechanical moving parts which can be affected by depositing solids out of the slurry thereon.

In the embodiment shown in Fig. 3, the flexible flap 20 is at the lower edge of the sloped surface 16 so that the closure members 19 open towards each other. A strap 30 extends from one closure member 19 to the other joined to the top of each closure member 19 by a machine bolt 31. The strap 30 is of sufficient length so that when one or the other of the closure members 19 are open, the other port 13 is closed. Both ports 13 may be open but only one port may be closed. This configuration is used to prevent slurry settling in the housing 11. In some situations where there are a large number of solid particles conveyed through a pipe line, a stoppage of both pumps must not allow both ports to close because the solid particles settle down in the valve housing causing silting which may prevent the closure members 19 from opening. Thus, the present embodiment provides a valve wherein one port 13 is always open and silting cannot occur in the housing.

Whereas two inlets are shown in the drawings it will be apparent to those skilled in the art that a plurality of inlets of any feasible number could be used to pump slurries into a housing. One or more outlets may then be provided for feeding the slurry to a conveying pipe line. As shown in the drawing, the closure member 19 rests on a seat 21 which is sloped at an angle to the horizontal. This is a preferred embodiment, however, the seat may be horizontal or may be positioned at almost any location provided one of the closure members 19 can close when there is no flow from that inlet port 13 into the interior of the housing 11. The configuration of the housing 11 shown in the drawings is formed of welded steel plate, however, this configuration could be a casting. The shape of the housing

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could be completely different provided the flaps had sufficient space to open to leave access from the inlet port to the outlet port, this is all that is required.

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The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A multiple inlet check valve for abrasive fluids comprising,

a valve housing having at least two inlet ports each of which is located on a separate surface sloped toward one another and one outlet port, the housing having an abrasive resistant lining throughout,

a closure member for each inlet port, the closure member including a top abrasive resistant layer and a bottom abrasive resistant layer, with a rigid disc sandwiched therebetween, the bottom abrasive resistant layer adapted to seal on the inlet port, and

a flexible flap integral with the closure member joined to each inlet port.

2. The check valve according to claim 1 wherein each of the flexible flaps is joined to an outer edge of each inlet port remote from the other inlet ports.

3. The check valve according to claim 1 wherein each of the flexible flaps is joined to an inner edge of each of the two inlet ports, and including a strap means between the closure members adapted to keep one inlet port open when the other inlet port is closed, and the other inlet port open when the one inlet port is closed.

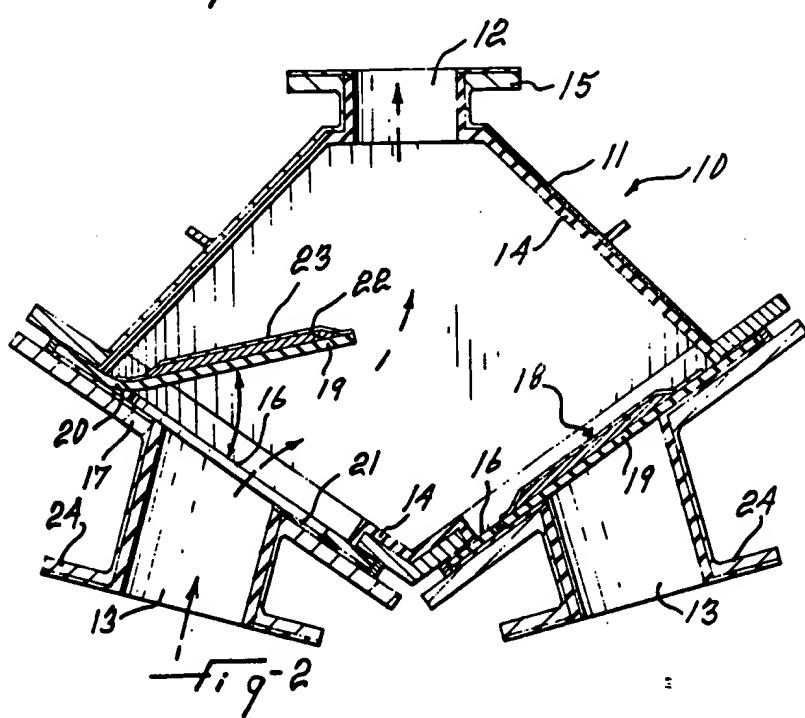
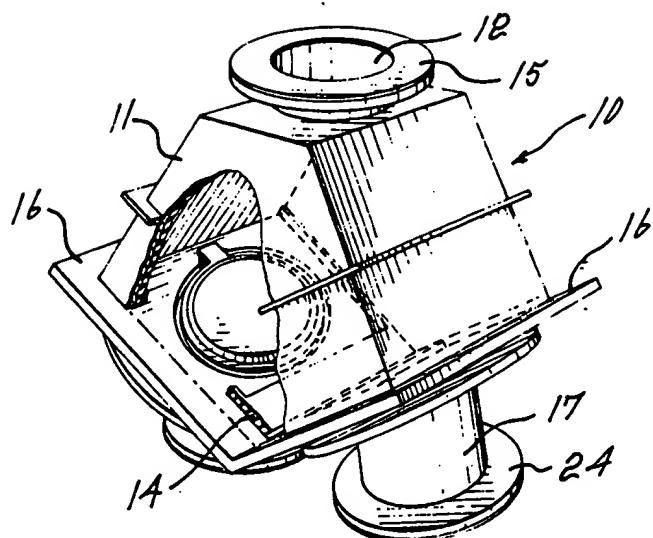
4. The check valve according to any of claims 1, 2 or 3 wherein there are two inlet ports and the valve housing is in the shape of an inverted Y.

5. The check valve according to any of claims 1, 2 or 3 wherein the abrasive resistant lining and the top and bottom abrasive resistant layers of the closure member are made of rubber.



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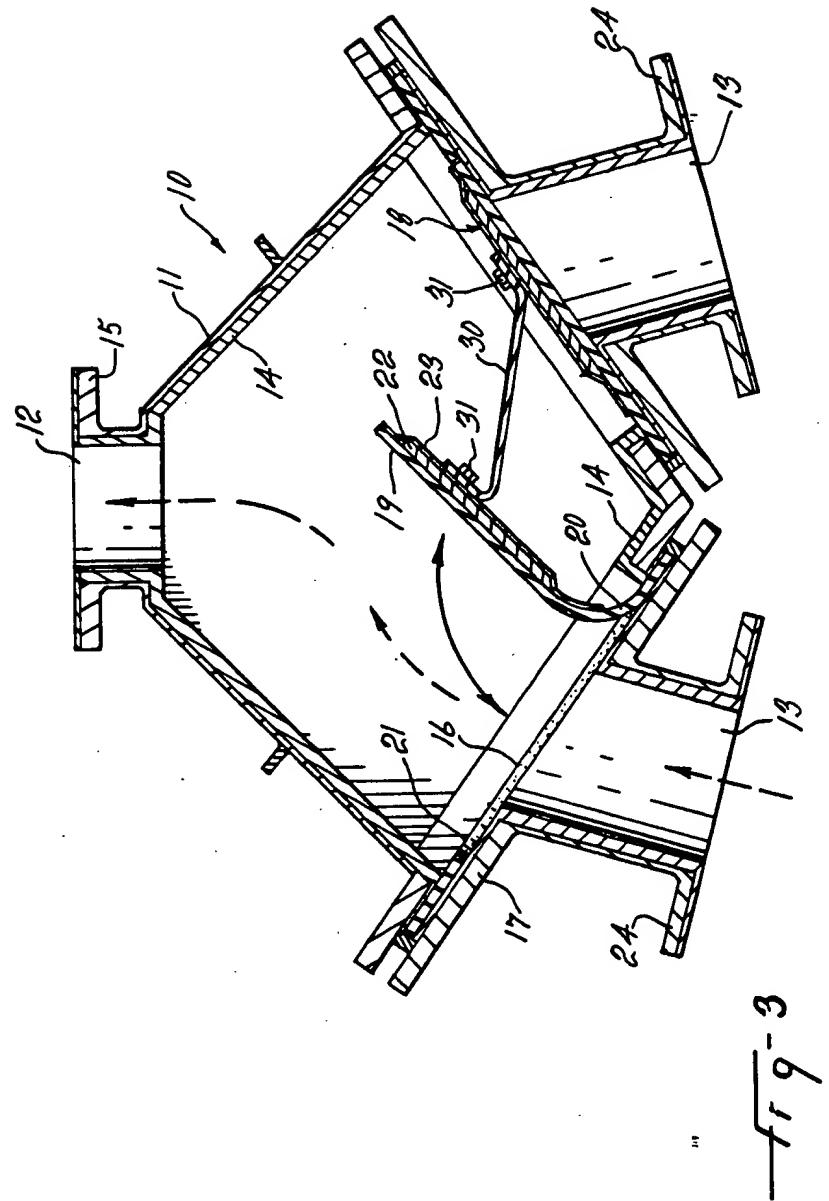


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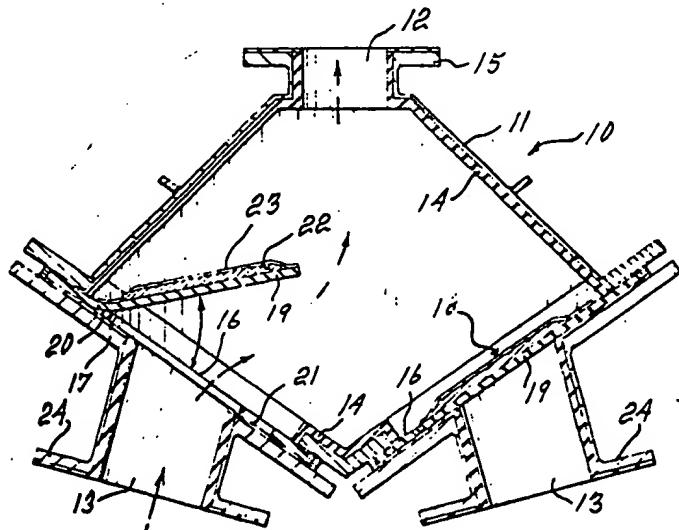
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 Multiple inlet hingeless check valve - has housing with abrasive resistant lining throughout and valve closure flaps with abrasive resistant layer

JACKSON L D A 02.05.79-CA-326798
 (21.09.82) F16k-11

02.05.79 as 326798 (968TJ)

The check valve for abrasive fluids comprises a valve housing having at least two inlet ports each of which is located on a separate surface sloped toward one another and one outlet port. The housing has an abrasive resistant lining throughout. A closure member for each inlet port, includes a top abrasive resistant layer and a bottom abrasive resistant layer with a rigid disc sandwiched between. The bottom abrasive resistant layer adapted to seal on the inlet port, and a flexible flap integral with the closure member joined to each inlet port.

Each of the flexible flaps is joined to an outer edge of each inlet port remote from the other inlet ports. In another embodiment each of the flexible flaps is joined to an inner edge of each of the two inlet ports, and includes a strap between the closure members adapted to keep one inlet port open when the other inlet port is closed, and the other inlet port open when the one inlet port is closed. (9pp Dwg.No.2/3)



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